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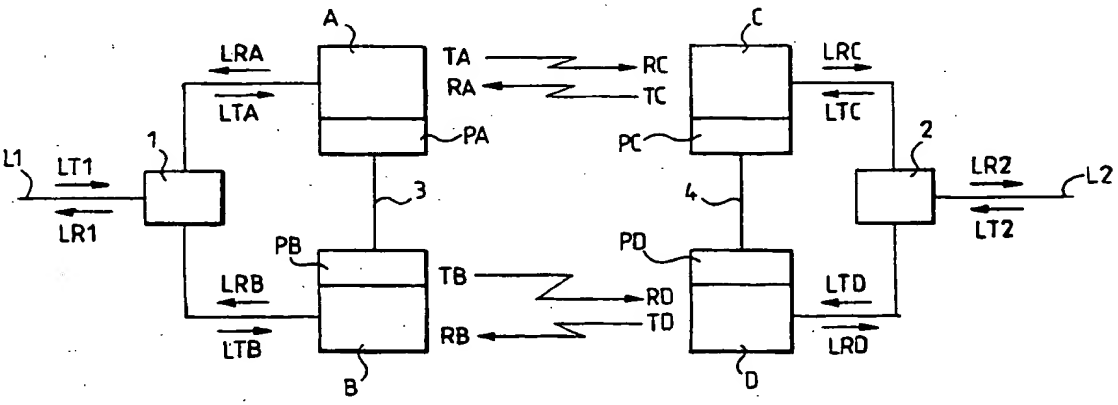

(57) Abstract

The invention relates to a method and a system for performing redundancy control of the baseband primary channel interfaces (L1; L2) of mutually substantially identical receivers (A, B; C, D) in a digital transmission device, such as a radio link or the like. The method according to the invention comprises the steps f: monitoring the quality of a signal (RA, RB; RC, RD) received from the transmission line; monitoring a possible failure indication or alarm signal concerning the transmission direction at the far end; performing a failure situation comparison between the mutually redundant receivers (A, B and C, D); performing redundancy control of the baseband primary channel interfaces of the receivers (A, B; C, D) on the basis of the failure situation comparison so that the signal of higher quality of the output signals (LRA or LRB; LRC or LRD) of the receivers (A, B; C, D) will be transmitted towards the primary channel (L1; L2).

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A method and a system for redundancy control of baseband channels in a telecommunications system

This invention relates to a method and a system for performing redundancy control of baseband primary channel interfaces of mutually substantially identical receivers in a digital transmission device, such as a radio link or the like.

Redundant transmission devices, which thus typically use two identical transmitters and receivers connected in parallel, e.g. a radio link, and a baseband branching means connected to them (so-called 1+1 redundancy), operate in both the inbound and outbound direction of a telecommunications network. The selection of the radio device to be used in each particular case usually depends on which one of the devices produces the signal of the highest quality.

In the so-called frequency redundancy, device redundancy is realized by having two signals of different frequencies propagating between the near end and far end, i.e. the system comprises two transmitter-receiver pairs operating at different frequencies. The so-called polarization redundancy is analogous, but it carries two signals having different polarizations.

By using a changeover control method, the control of device redundancy of a radio link jump secured by frequency or polarization redundancy is effected, i.e. a reliable and simple device redundancy (not hitless) for the radio link jump.

In the prior-art changeover control methods, the signal received by the less faulty receiver is selected as a line signal. At the far end, it may happen that one of the transmitters is faulty, and therefore forwards an alarm signal AIS (Alarm Indication Sig-

nal), whereas the stand-by transmitter is completely faultless. A drawback of the known methods is that as radio links do not usually identify the information content of a signal to be transmitted, a received AIS signal will not bring about failure detection in the radio link, and so it is quite possible that the AIS signal is selected for transmission to the line, even though the stand-by signal would be faultless.

The object of this invention is to eliminate the drawbacks of the above-mentioned known methods. To achieve this, the method according to the invention is characterized in that the method comprises the following steps:

- monitoring the quality of a signal received from the transmission line;
- monitoring a possible failure indication or alarm signal concerning the transmission direction at the far end;
- performing a failure situation comparison between the mutually redundant receivers;
- performing redundancy control of the baseband primary channel interfaces of the receivers on the basis of the failure situation comparison so that the signal with higher quality of the output signals of the receivers will be transmitted towards the primary channel.

The method according to the invention has the following advantages:

- the changeover control method according to the invention allows reliable and simple device redundancy to be realized for a radio link jump with no other external changeover control means than a passive baseband branching means and cabling between the redundant pair;
- reception and transmission may take place over

different pairs of the redundant link jump, whereby transmission of one pair and reception of the other pair may fail without a break in the connection in either direction;

- the method according to the invention can be used in any transmission device using a baseband branching means and a connection between far-end and near-end control means.

Preferred embodiments of the method according to the invention and the system according to the invention are characterized by what it disclosed in the attached claims.

In the following the invention will be described more fully by way of example with reference to the attached drawing, which shows two mutually communicating radio links forming part of a baseband network.

The figure shows a redundant system. It comprises four identical transmitter-receiver radios A, B, C and D, which form two redundant pairs A, B and C, D; and two passive baseband branching means 1 and 2. The structure of suitable baseband branching means is described more closely e.g. in the Applicant's Finnish Patent No. 87 123. A signal LT1 from a line L1 is branched in the baseband branching means 1 to the radio units A and B, while a signal LT2 from a line L2 is branched in the branching means 2 to the units C and D. Correspondingly, either one of signals RA or RB received by the radio unit A or B is selected through the branching means 1 as a signal LR1 to be transmitted to the line L1, and either one of signals RC or RD received by the radio unit C or D is selected through the branching means 2 as a signal LR2 to be transmitted to the line L2.

An in-built microcomputer or microprocessor PA, PB, PC, PD with its software takes care of the func-

tions of each one of the radios. The redundant pairs A, B and C, D are interconnected by control buses 3 and 4. The microprocessors of the redundant pair communicate with each other over the control bus, the exchange of failure information forming part of the communication.

A changeover control algorithm according to the invention is based on two criteria:

deterioration of a signal from the transmission line at the near end (RXF=RX Failure), whereby the quality of the signal received from the transmission line is monitored; or

a failure occurring at the far end in the transmission direction (FTXF=Farend TX Failure), whereby a possible failure indication or alarm signal concerning the transmission direction is monitored at the far end; this failure has thus already been detected in the failed far-end device itself and transmitted to the near end on a control channel multiplexed into a radio frame (e.g. 8-bit).

The algorithm, i.e. the software stored in the microcomputers PA to PD, performs at intervals a failure situation comparison between the mutually redundant receivers, on the basis of which the redundancy control of the baseband primary channel interfaces of the receivers is carried out by controlling the receive-direction output buffers so that the signal with higher quality of the received signals is forwarded towards the primary channel. If the failure situation comparison produces signals of equal quality, the receiver that transmits to the line is not changed. The changeover criteria may have different priorities; near-end failures (RXF) preferably have a higher priority than far-end failures (FTXF).

Propagation of a signal transmitted from one

radio link to another will be described further below with reference to the attached figure. It will suffice for the present purposes that the propagation of the signal is described in one direction only, in this specific case from the far end A, B to the near end C, D (LT1->LR2), as the reverse direction is functionally identical. As transmission and reception take place on different channels between A-C and B-D, the directions do not either affect each other.

The signal LT1 from the line L1 is divided in the passive baseband branching means 1, so that it has two propagation paths to the receiving radio link, in this case to the near end:

LT1 -> LTA -> TA -> RC; or

LT1 -> LTB -> TB -> RD.

The control of the receive-direction output buffers of the radio is used as the changeover device of the radio devices. It takes care that only one of the units of the redundant pair C and D at the near end is allowed to transmit its baseband output signal (LRC, LRD) through the baseband branching means 2 to the line. The microprocessors of the units select the unit which is allowed to transmit - C or D - on the basis of the failure situation analysis.

In practice, the software of one of the microprocessors of the redundant pair operates in a so-called Master state and the other in a so-called Slave state. Only the unit in the Master state is allowed to transmit a signal to the line as the LR2 signal. The failure situation analysis at the near end (analysing the quality of the output signals LRC and LRD) and the Master/Slave selection between the near-end units are performed in such a way that the unit in the Master state reads its own failure situation at predetermined intervals and asks for a similar situation from the

unit in the Slave state through the control bus 4. The unit in the Master state performs the failure situation comparison and if it detects that the unit in the Slave state has more serious failures, that both units have equally serious failures, or that neither one of the units has failures, the unit in the Master state retains the changeover control, thus feeding a signal to the line. If the unit in the Master state detects that it has more serious failures than the unit in the Slave state, it performs the changeover of states in the following way: Master -> Slave, Slave -> Master, so that the unit or radio transmitting to the line also changes.

If the far-end A, B detects a failure in the transmission direction or knows that the outbound signal TA or TB is a failure or alarm signal (AIS), the corresponding receiving radio C or D is informed of the failure on a control channel multiplexed into the signal frame. Control channels between radio links are as such previously known, and will not be described more closely herein. According to the invention, however, the receiving radio reads the failure data by demultiplexing the control channel provided in the digital data transmission frame.

Information from the control channel is taken into account in the failure situation comparisons performed by the near-end Master unit. For instance, if C has been the Master unit and neither one of the redundant radios has failures, but the near end receives data indicating that the far-end unit A is faulty, the Master performs the Master/Slave changeover in the favour of unit D, so that the superior signal LRD produced by the link B-D is fed to the line LR2. With the markings used in the figure, the signal path LT1 -> LTA -> TA -> RC -> LRC -> LR2 thus changes

into the signal path LT1 -> LTB -> TB -> RD -> LRD -> LR2. If the far-end failure occurred in unit B, no change is performed.

Signals shown in the figures that so far have not been mentioned are related to an identical but reverse communication event where the optional paths for the signal are:

LT2 -> LTC -> TC -> RA -> LRA -> LR1, and

LT2 -> LTD -> TD -> RB -> LRB -> LR1; thus they are not significant for the understanding of the invention.

It is obvious to one skilled in the art that the different embodiments of the invention are not limited to the above example, but they may vary at will within the scope of the attached claims. Accordingly, the invention may be applied in any transmission device that uses a baseband branching means and a connection between far-end and near-end control means.

Claims:

1. Method for performing redundancy control of baseband primary channel interfaces (L1; L2) of mutually substantially identical receivers (A, B; C, D) in a digital transmission device, such as a radio link or the like, c h a r a c t e r i z e d in that the method comprises the steps of:

- monitoring the quality of a signal (RA, RB; RC, RD) received from the transmission line;

- monitoring a possible failure indication or alarm signal concerning the transmission direction at the far end;

- performing a failure situation comparison between the mutually redundant receivers (A, B and C, D);

- performing redundancy control of the baseband primary channel interfaces of the receivers (A, B; C, D) on the basis of the failure situation comparison so that the signal with higher quality of the output signals (LRA or LRB; LRC or LRD) of the receivers (A, B; C, D) will be transmitted towards the primary channel (L1; L2).

2. Method according to claim 1, c h a r a c t e r i z e d in that a failure indication or alarm from the far end is transmitted to the near end by radio with a control-channel frame.

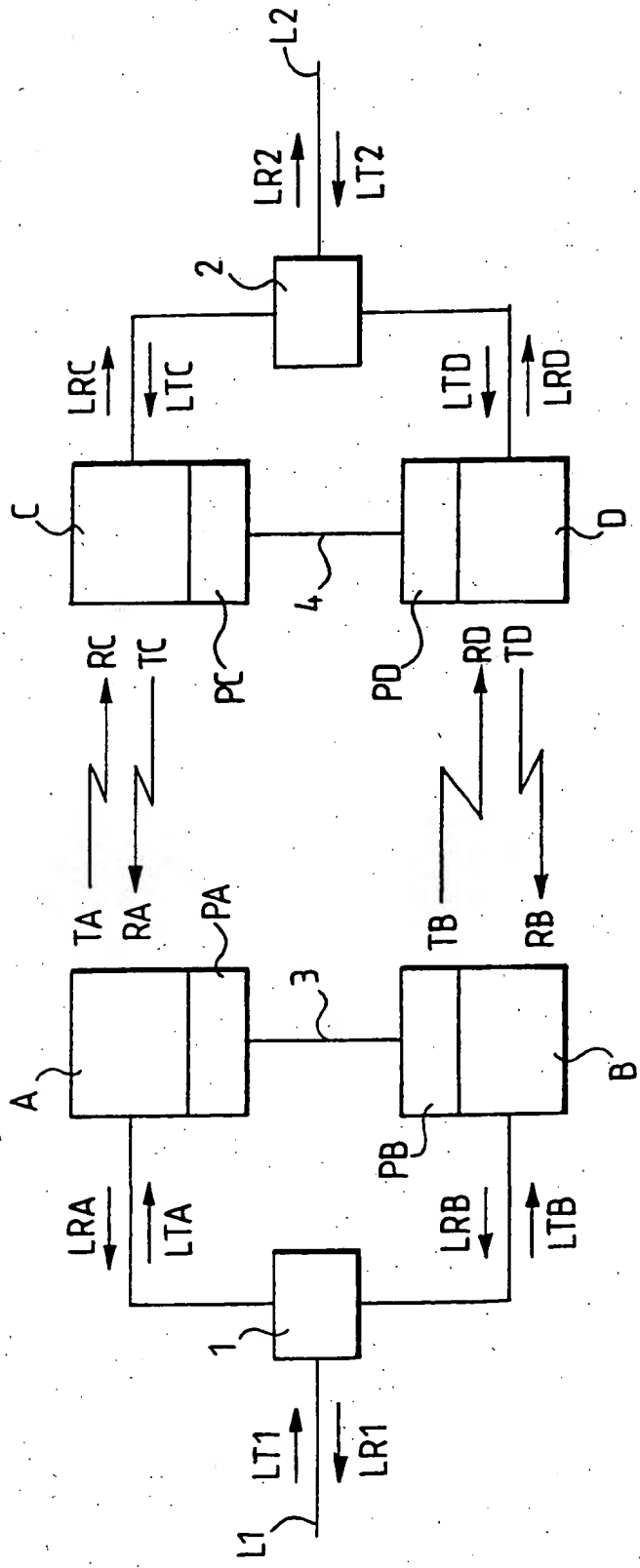
3. Method according to claim 1 or 2, c h a r a c t e r i z e d in that the quality of the received signal (RA, RB; RC, RD) has a higher priority in the redundancy control than possible far-end failure indications.

4. System for performing redundancy control of the baseband primary channel interfaces of mutually substantially identical receivers (A, B, C, D) in a

digital transmission device, such as a radio link or the like, characterized in that the system comprises computers (PA, PB, PC, PD) in association with each one of the receivers (A, B, C, D), providing a communication bus (3; 4) between the computers (PA, PB and PC, PD) of each redundant receiver pair (A, B and C, D) in order to monitor the quality of a signal (RA, RB; RC, RD) received from the transmission line (L1; L2) and a possible failure indication or alarm signal concerning the transmission direction at the far end, compare the failure situations of the receivers, and perform the redundancy control of the baseband primary channel interfaces of the receivers (A, B; C, D) on the basis of the failure situation comparison so that the signal with higher quality of the output signals (LRA or LRB; LRC or LRD) of the receivers (A, B; C, D) will be transmitted towards the primary channel.

5. System according to claim 4, characterized in that the system comprises a control channel for receiving a failure indication or alarm from the far end over the radio link.

6. System according to claim 4 or 5, characterized in that the receivers (A, B; C, D) are connected to a common baseband branching means (1; 2) formed by passive components.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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 94/00372

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04B 1/74
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIL, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim N.
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Y	Patent Abstracts of Japan, Vol 13,No 444, E-828, abstract of JP, A, 1-170124 (NEC CORP), 5 July 1989 (05.07.89) --	1-6
A	US, A, 5034966 (P.A. HOCHSTEIN), 23 July 1991 (23.07.91), column 1, line 40 - column 2, line 44, figure 2, abstract --	1,4,6

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB, A, 2250894 (TELENOKIA OY), 17 June 1992 (17.06.92), page 1, line 1 - page 2, line 26 --	1-6
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INTERNATIONAL SEARCH REPORT

Information on patent family members

26/11/94

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